

II. Rejection of Claims 1, 2, 4 and 9 Under 35 U.S.C. §103

Claims 1, 2, 4 and 9 stand rejected under 35 U.S.C. §103 as being unpatentable over Sato et al. in view of Stewart et al.

The present system, as recited in claim 1, affords for automatic inspection of all critical parameters of integrated circuit probe cards. The system includes a viewing system for providing a digital image of the tip of each probe and a window with a flat surface contacted by each of the probe tips such that the viewing system obtains the digital image of each probe tip through the window. The system further includes a computer means with software means to determine and analyze the position of each probe within the digital image, and positioning means to determine the position of each probe tip in the digital image relative to a known physical position in order to determine the location of the probes relative to each other. Moreover, the computer means includes automated means for evaluating a characteristic of at least one bus probe included in the probe array based on the relative location information. As pointed out in the present application, bus probes present unique circumstances which render their evaluation even more difficult to automate.

The Examiner asserts that it would have been obvious to employ the system for wafer probing disclosed in Sato et al. to the probe card inspection system of Stewart et al.. However, there is no motivation or suggestion for the combination of Sato et al. and Stewart et al. as relied upon by the Examiner. Furthermore, even if the references were combined, applicants' invention would not result.

As previously pointed out, Sato et al. relates to a wafer prober with the ability to orient and position a probe card and automatically assure the optimal alignment of the probes on the card to the pads on the wafer. Sato et al. does not address testing of the probe card for proper positioning of the probes with respect to each other so that they will fit appropriately on the array of pads on the wafer. Furthermore, Sato et al. does not address testing any other parameters on the card such as planarity, contact resistance, gram force, etc. The Sato et al. device makes use of two cameras and requires the presence of a wafer in conjunction

with the probe card. One camera is viewing the wafer and the other is viewing the probe tips. Various calibration techniques are employed to reference the two cameras with respect to each other. The system takes the position of the "corner" probes as representative and uses these or some other limited set to establish position to the pads on the integrated circuit. It employs the pattern of the probes read by the camera as a map to search for bonding pad locations on the wafer with the second camera by using the probe positions to qualify candidates, then verifying the presence of a bonding pad by image processing techniques. Movements of the probe card and the wafer are then executed to move the two into proper alignment with each other.

Applicants respectfully submit that Sato et al. does not teach or suggest the claimed automated means for evaluating a characteristic of at least one bus probe included in the probe array based on the relative location information as recited in claim 1. The Examiner has not indicated where in Sato et al. such automated evaluation of a bus probe occurs. In fact, applicants contend that Sato et al. does not teach or suggest facilities for such evaluation particularly since the probe card in Sato et al. is being used, not tested.

Moreover, the Examiner does not indicate where, if at all, Stewart et al. discloses such an automated means for evaluating a bus probe. In fact, no reference has been found in Stewart et al. in relation to such automated means. Consequently, it is respectfully submitted that the Examiner has failed to establish even a *prima facie* basis for the rejection of claim 1.

Furthermore, Stewart et al. relates to an electrical method and apparatus for inspecting integrated circuit probe cards. The electrical method disclosed in Stewart et al. determines the X, Y positions of probes by ascertaining the contact point of each probe on orthogonal conducting strips on an insulating material. However, this technique is only suitable for coarse approximations since the flat shape of each probe tip results in the contact point between the probe tip and the conducting strips to be offset from the center of the probe tip. Consequently,

measurement errors manifest which are proportional to the diameter of the probe or the distance thereacross if shaped other than a circle.

Additionally, the technique of Stewart et al. requires that the probes be brought into contact with the insulating material and conducting strips numerous times in order to determine the X, Y positions of all the probes. As a result, the probe tips are subject to excessive wear. For example, since the insulating material employed is typically ceramic, the probe tips may be abraded excessively and pick up contaminants from the rough ceramic surface.

Applicants' invention, as recited in claim 1, affords for a superior means to determine the array of probe tips - especially in regards to adjusting the heights of the probes to form a more planar array. Applicants' invention provides for a positioning means to determine the position of each probe in the digital image relative to a known physical location in order to determine the location of the probes relative to each other. Moreover, applicants' invention further includes an automated means for evaluating a characteristic of at least one bus probe included in the probe array based on the relative location information.

Thus, Stewart et al. fails to make up for the deficiencies of Sato et al. Consequently, Sato et al. in view of Stewart et al. does not teach or suggest applicants' invention as set forth in claim 1. Regarding claim 9, the invention relates to a method for learning the probe tip locations for a plurality of probe tips in an existing known good probe card. In particular, a digitized image of each probe tip on the probe card is captured and the relative position of each probe tip is then determined with respect to the other probe tips on the probe card. A file of the relative position information is constructed for use in determining the correct placement of probe tips on other probe cards of a same type. Sato et al. teaches only the feature of identifying the location of probe tips using a video camera but does not teach or suggest a method for accumulating a file of relative position information for use in identifying the correct placement of probe tips on other probe cards. Sato et al. is concerned only with matching the probe card in its present, non-overdriven state to the wafer.

Stewart et al. relates to a system for inspecting a probe card, but does not teach or suggest the concept of digitizing and determining the relative positions of probe tips in a known good probe card as claimed. Specifically, Stewart et al. does not teach or suggest constructing a file of the learned relative position information for use in determining the correct placement of probe tips on other probe cards of the same type. Again, therefore, Stewart et al. does not make up for the deficiencies in Sato et al.

Accordingly, the rejection under 35 U.S.C. §103 of claim 1 and claims 2 and 4 which depend therefrom along with independent claim 9 should be withdrawn.

II. Rejection of Claims 3, 5, 8 and 10 Under 35 U.S.C. §103

Claims 3, 5, 8 and 10 are rejected under 35 U.S.C. §103 as being unpatentable over Sato et al. in view of Stewart et al. (presumably, although it is unclear from the Office Action) and further in view of Chang et al. This rejection is respectfully traversed for at least the following reasons.

Claims 3 and 5 depend from claim 1. Chang et al. does not make up for the deficiencies of Sato et al. and Stewart et al. advanced above in regards to the patentability of claim 1. Accordingly, the rejection of claims 3 and 5 under 35 U.S.C. §103 should be withdrawn.

In regards to claim 8, neither Sato et al., Stewart et al. or Chang et al. whether viewed alone or in combination teach or suggest measuring the length of a probe tip extending from a probe shank as claimed. Claim 8 defines an apparatus in which a contacting means sequentially contacts a distal end of the probe tip and the shank from which the probe tip extends. A measuring means measures the vertical height of each contacted point and a calculating means determines the difference in the two measured heights in order to determine the length of the probe tip. This aspect of the invention is best exemplified in Figs. 7a and 7b.

The Examiner has failed to indicate where in any of the applied references there is any teaching or suggestion measuring of the length of the probe tip as

recited in claim 8. Absent any such teaching or suggestion, the rejection is clearly improper.

Likewise, neither Sato et al., Stewart et al. or Chang et al. viewed alone or in combination teach or suggest the specific method recited in claim 10 for determining the orientation and spatial position of an array of probes. There is no teaching or suggestion of moving the field of view of a video microscope in a predetermined direction not exceeding the X or Y dimension of the array, and then, if no probes are found, moving along the opposite direction and along the positive and negative directions of the other axis until probes are found in the field of view.

Accordingly, withdrawal of the rejection under 35 U.S.C. §103 of claims 3, 5, 8 and 10 is respectfully requested.

III. Conclusion

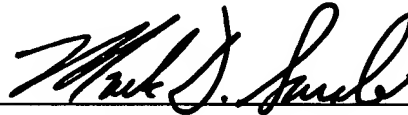
For at least the above reasons, claims 1-5 and 8-10 are believed to be allowable and the application in condition for allowance. A prompt action to such end is earnestly solicited.

Should the Examiner believe that a telephone interview would be helpful to expedite favorable prosecution, the Examiner is invited to contact Applicant's undersigned representative at the telephone number listed below.

In the event any fees are due in connection with the filing of this document, the Commissioner is authorized to charge those fees to Deposit Account No. 18-0988.

Respectfully submitted,

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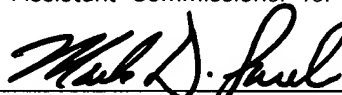
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